

Non-Radioisotope Power Systems For Sunless Solar System Exploration Missions

Completed Technology Project (2011 - 2012)



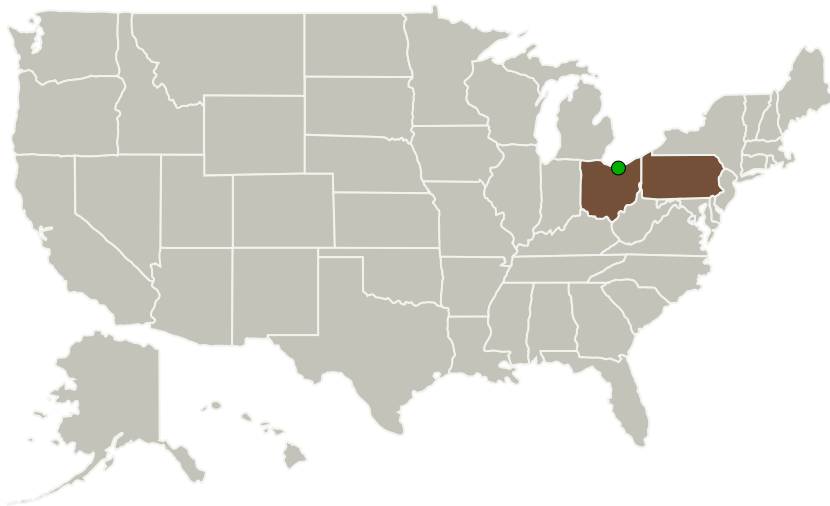
Project Introduction

Several targets of interest in solar system exploration require non-solar power sources due to permanent shading from craters or clouds or due to extreme distance from the sun. These missions are typically considered with radioisotope power sources, but the scarcity of such fuel reduces the number of missions that NASA can execute in any decade. This study will explore mission architectures to the Moon's southern Aitken Basin, the surface of Saturn's moon, Titan, and the surface of Venus that do not rely on Plutonium for power, but instead are powered by a metal-combustion engine. The Applied Research Lab at Penn State has been developing advanced metal combustion systems for power generation through turbines and Sterling engines that have significantly higher energy density than chemical batteries. This NIAC study team will chose one of these missions to study in detail at the NASA Glenn Research Center's COMPASS Lab, resulting in a mission concept report. Proving the feasibility of using metal combustion to power spacecraft in sunless regions would be a breakthrough and shift our expectation of what explorations are possible through Discovery and New Frontiers missions without relying on radioisotope power sources.

Anticipated Benefits

This project could enable science personnel on earth to interact and retarget science - something not possible with a ~2 hour spacecraft lifetime. It also allows for contingency operations directed by the ground (reduced risk). The science package was based on that envisioned by the Venus Intrepid Tessera Lander (VITaL) Decadal Survey Study.

Primary U.S. Work Locations and Key Partners



Non-Radioisotope Power
Systems For Sunless Solar
System Exploration Missions

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission
Directorate (STMD)

Responsible Program:

NASA Innovative Advanced
Concepts

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Organizations Performing Work	Role	Type	Location
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio
QNA Corp	Supporting Organization	Industry	

Primary U.S. Work Locations	
Ohio	Pennsylvania

Project Transitions

September 2011: Project Start

September 2012: Closed out

Closeout Summary: Educational outreach: Presented research at the From Science Fiction to Science Fact Seminar at the Chicago Museum for Science and Industry to ~350 students and their families. Supported several student projects at MSI.

Project Management

Program Director:

Jason E Derleth

Program Manager:

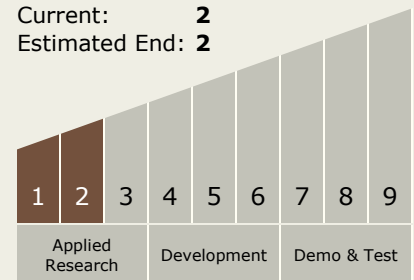
Eric A Eberly

Principal Investigator:

Michael S Paul

Technology Maturity (TRL)

Start: **1**
Current: **2**
Estimated End: **2**



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - TX03.1 Power Generation and Energy Conversion
 - TX03.1.4 Dynamic Energy Conversion

Target Destinations

The Moon, Others Inside the Solar System